Attachment 13 –
Attachment 4 of Pamela Sihvola and LA Wood Letter June 7, 2005

INTRODUCTION

This report summarizes the oversight activities of the State of California. Specific information for January through September, 1995 is discussed as well as information referencing conclusions and suggestions for future oversight activity resulting from all efforts of the Agreement in Principle (AIP) program from September 1990 through September, 1995. All the information is relative to U.S. Department of Energy (DOE) facilities within the State. Authority and funding for these oversight activities are through the AIP between the California Department of Health Services (DHS) and the DOE. The AIP does not fund any regulatory activities. The AIP was approved by DOE and DHS in 1990 and is being terminated in September 1995.

The AIP was developed in an effort to provide increased access by state agencies to DOE facilities to allow for improved oversight. The agreement was designed as a measure to assist in assuring citizens of the State of California that their health, safety, and environment are protected through a program of independent monitoring and oversight by state agencies. The agreement is administered by the Environmental Management Branch (EMB) within the Division of Drinking Water and Environmental Management (DWEM), with assistance from the State Water Resources Control Board (SWRCB). EMB's laboratory support is provided by the Sanitation and Radiation Laboratory Branch (SRLB) within the DWEM. This final report on the AIP Program is compiled, published and made available to DOE in an effort to provide information to be used in the continuation of the oversite activities initiated and/or determined necessary by Department of Health Services' efforts in the AIP. The report is also made available to the public with the intention of providing an overview for readers of the State's AIP activities.

There were currently six DOE facilities in California that are covered by the AIP. They are listed below.

- Lawrence Livermore National Laboratory (LLNL) in Livermore (including Site 300 east of Livermore)
- Sandia National Laboratory (SNL) in Livermore
- Lawrence Berkeley National Laboratory (LBNL) in Berkeley
- Stanford Linear Accelerator Center (SLAC) in Palo Alto

- Laboratory for Energy-Related Health Research (LEHR) in Davis
- Energy Technology Engineering Center (ETEC) in Simi Valley

By administering the AIP for the State, EMB was charged with providing oversight of state agencies participating in the AIP. EMB contracted with the SWRCB for performance of work in areas where their expertise is necessary to accomplish the goals of the AIP.

SWRCB's role in the AIP was to evaluate water quality, both surface water and groundwater. EMB acted as the liaison between DOE and SWRCB for site visits, meetings, document reviews, and technical report evaluations. Meetings between EMB and SWRCB were held as needed to discuss procedures and findings. Technical staff from EMB and SWRCB worked together as teams assigned to specific DOE sites.

This report focuses on the accomplishments and activities of EMB and SWRCB from January through September 1995 and includes recommendations for future direction for DOE based on the entire five year period of the DHS' involvement in the AIP. Actual reports, memos, letters, and sample results for the information included in this report will be maintained on file at the EMB office in Sacramento until they are archived for storage purposes.

One purpose of the AIP was to provide public assurance that DOE is acting in a responsible manner in respect to public health, safety and the environment. The direction taken by the AIP program was to demonstrate that the environmental monitoring programs at the various DOE facilities were adequate to monitor the effects of the sites, that the data resulting from these programs were valid and that any negative or potentially negative effects were being dealt with, in an appropriate manner. The site specific summaries found in this document detail this process and include findings or recommendations that would apply. As far non-site specific DOE operations are concerned, the AIP has observed and attempted to assist in furthering communications between DOE and the public. DOE has the reputation of being closed to communication and unreachable, DHS through the AIP has noted that DOE could begin to overcome this reputation if effort were made to gather public input early in the process. Rockwell, International has started a new project for public information concerning the Santa Susanna Field Laboratory DOE could use to model programs for other site.

Activities and Meetings

Date	Description of Activity or Meeting
January 3, 1995	TLD exchange.
February 1, 1995	Quarterly Environmental Restoration meeting.
February 15, 1995	Stable isotope meeting.
February 23, 1995	Surface water sampling event, split samples with LBNL.
April 3, 1995	TLD exchange.
April 13-14, 1995	AIP Annual Meeting at Newport Beach.
April 26, 1995	Quarterly Environmental Restoration meeting.
April 26, 1995	Quarterly AIP Progress Meeting.
May 4, 1995	Exchange tritium results with LBNL EH&S.
May 11, 1995	Groundwater sampling event, split samples with LBNL Environmental Restoration Group.
May 26, 1995	Sent package containing lab results and comparison of results with LBNL from December, 1994 surface water sampling event.
June 7, 1995	Groundwater sampling event, split samples with LBNL Environmental Restoration Group.
June 15, 1995	Surface water sampling event, split samples with LBNL.
July 5, 1995	TLD exchange.
July 26, 1995	Quarterly Environmental Restoration meeting.
August 29, 1995	Submitted analytic results of the AIP Program's participation in groundwater sampling, and analytic results from the stable isotope study to LBNL Environmental Restoration Program and LBNL Environmental Monitoring Program.

Activities and Meetings (cont.)

Date	Description of Activity or Meeting
September 6, 1995	Meeting with Leticia Menchaca regarding results of surface water and groundwater stable isotope analysis.
September 8, 1995	Submitted analytic results of the AIP Program's participation in groundwater sampling, and analytic results from the stable isotope study to DOE.

Accomplishments

Completed 1994 AIP Annual Report.

Completed January 1995 TLD exchange and sent fourth quarter 1994 dosimeters to vendor for analysis.

Completed April 1995 TLD exchange and sent first quarter 1995 dosimeters to vendor for analysis.

Completed assembly and initial testing of tritium in air sampling equipment.

Began draft procedures and Project Monitoring Plan for tritium in air sampling.

Prepared spiked silica gel samples and delivered them to SRLB for analysis and QA.

Prepared spiked metals samples for field sampling Quality Assurance study. These were split with LBNL on the February 1995 surface water sampling event.

Prepared spiked tritium samples to split with LBNL for field sampling Quality Assurance study.

Began initial testing of automatic storm water monitoring equipment. System set up at Sandia National Laboratory to evaluate programming system and reliability of automation with water level actuator.

Completed July 1995 TLD exchange and sent second quarter dosimeters to vendor for analysis.

Began collecting groundwater samples for stable isotope analysis. By agreement with LBNL Environmental Restoration groundwater sampling staff routinely collected samples. AIP personnel

picked up the samples, relabeled them so the samples were submitted to the laboratory without indication of their origin, and transported them to LBNL for stable isotope analysis.

State Water Resources Control Board (SWRCB) completed draft PMP for ground water sampling, distributed draft PMP for review and comment.

Implemented draft PMP for ground water sampling - participated in two groundwater sampling events.

Completed 1995 AIP Program Final/Annual Report.

AIP ENVIRONMENTAL MONITORING

AIP program environmental monitoring projects around LBNL are designed to complement, or operate in parallel with, LBNL's environmental monitoring programs. They are intended to be an additional quality assurance check and provide independent laboratory results for comparison. In 1995 the AIP Program continued monitoring direct gamma radiation, split surface water samples for comparative analysis of radionuclides and metals, and split groundwater samples from several selected monitoring wells.

The AIP Program also initiated a comprehensive stable isotope sampling program. It is expected that this study may provide information to evaluate groundwater models and facilitate a better understanding of the hydrogeology of this complex site.

Direct Radiation Monitoring

Direct radiation monitoring was initiated in January 1993. Thermoluminescent dosimeters (TLDs) obtained from Radiation Detection Company (RDC) in Sunnyvale, California were used to make comparison measurements of direct gamma radiation. Each RDC TLD contained four capsules of powdered dysprosium activated calcium sulfate ($CaSO_4$) in a heat sealed envelope. The envelopes were exposed for one calendar quarter and returned to RDC for analysis.

Two RDC TLDs were collocated with TLDs placed LBNL at the six environmental monitoring locations in table LBNL-1. Two additional TLDs, described as controls, were placed with controls from LBNL in the Sacramento office of the AIP Program. At TLD locations B-13A and B-13D, one of the TLDs was placed outside LBNL's environmental monitoring shed. The TLDs were exchanged quarterly, during the first days of each quarter; Table LBNL-2 lists the exact exchange dates. Transit and storage control TLDs were used to differentiate direct radiation

exposure in the field versus exposure during storage or transit. The values presented in Tables LBNL-3 and LBNL-4 reflect subtraction of these storage and transit exposures. The analytical laboratory is not aware of the placement of any of the TLDs, which are duplicates, or which are controls.

Discussion of Direct Gamma Radiation Monitoring Results

The TLD results reported in Table LBNL-3 and Table LBNL-4 include duplicate measurements at the same monitoring location. The duplicate TLD results show good agreement. TLDs at locations B-13A and B-13D, where one of the TLDs was placed inside and the other placed outside LBNL's environmental monitoring buildings also show good agreement, indicating that, at under the current operating conditions, shielding provided by the buildings may not be significant.

Instantaneous gamma exposure rates are measured at a single point in time, whereas the exposure rates in Table LBNL-3 are the mean values from the four TLD capsules integrated for three months, plus or minus two standard deviations of the mean. Considering these differences, average exposure rates for each quarter agree well with the measurements made with a portable survey instrument at the time of TLD exchange.

The measured direct radiation monitoring results for LBNL are all typical of values obtained from naturally occurring direct radiation sources. Direct radiation monitoring at LBNL may be continued by the State of California, Department of Health Services, Radiologic Health Branch.

Suggested Areas for Further Investigation

- The practice of placing TLDs inside metal buildings to monitor direct environmental radiation raises the question of shielding provided by the structure of the building. While results from the AIP Program TLDs placed inside and outside the buildings seem to indicate that this may not be a significant concern for present operations, but this data set is not large enough to be considered statistically significant.

- The AIP Program has been unable to compare environmental direct radiation measurements with results obtained by LBNL because of LBNLs procedure of reporting a relative measurement as opposed to the actual measurement as the AIP Program does. LBNLs procedure calls for the subtraction of the results from a "background location" from the results of all other locations, reporting zero exposure for all locations rather than actual exposure. It is likely that results obtained by LBNL correlate reasonably well with results obtained by the AIP Program, but this can not be demonstrated.

- LBNL is planning in the near future to begin operation of the Advanced Light Source. It

will be a new potential source of direct radiation, and the placement of environmental dosimeters should be evaluated.

Surface Water Monitoring

There is apparently some ambiguity about the names of streams and sampling locations at LBNL, especially with regards to Blackberry Creek (North Fork of Strawberry Creek). The AIP Program adopted the names used by the LBNL Environmental Group in Natural Waters Sampling Procedures (August 1992).

Surface water at LBNL is found mainly in two small perennial streams, Blackberry Creek (also known as North Fork of Strawberry Creek), Strawberry Creek, and associated ephemeral tributaries that drain the LBNL site. Strawberry Creek drains the southern portion of LBNL, and Blackberry Creek drains the northern portion of LBNL. These creeks combine, flow through the University of California at Berkeley campus, eventually connect with the City of Berkeley storm water drainage system, and finally exit into San Francisco Bay. This surface water may be affected by the influx of groundwater, rainwater, storm water, waste water and sewage leakage, air deposition, and discharge from hydraugers. Any or all of these constituents may be a potential source of contamination to the surface water itself.

LBNL Environmental Monitoring Group collects surface water grab samples once a week from five locations, (Blackberry Creek, Upper Strawberry Creek, Lower Strawberry Creek (below the confluence of Blackberry and Upper Strawberry Creeks), and from two off-site streams -- Claremont Creek and Wildcat Creek (see Table LBNL-6). These samples are routinely analyzed by LBNL for gross alpha, gross beta and tritium. The LBNL Environmental Restoration Group collects quarterly surface water samples from streams that flow through LBNL from locations that do not necessarily correspond to the Environmental Monitoring Group sampling locations. These samples are analyzed for VOCs and tritium.

On December 15, 1994, AIP Program staff accompanied LBNL Environmental Monitoring Group staff on one of the weekly surface water sampling trips to collect duplicate grab samples for independent, comparative analysis of radionuclides. Duplicate samples were collected and submitted to the laboratory for analysis to test the reproducibility of the sampling and analysis processes.

The Department of Health Services Sanitation Radiation Laboratory in Berkeley (SRLB) performed the AIP Program's analysis. Samples submitted to SRLB were labeled only as LBNL surface water collected on December 15, 1994. SRLB was not provided with any information about the specific sample locations, specific times of collection, or duplication of samples. The results from the analysis of these samples is reported in the 1994 AIP Program Annual Report.

There were no significant differences in results between the AIP Program and LBNL split samples or between the AIP duplicate samples.

In 1995, the AIP Program participated in two surface water sampling events -- February 23, 1995 & June 15, 1995. Samples were split with LBNL at all locations. Samples were collected for tritium, gross alpha, gross beta, and metals analysis. In addition to duplicating samples from several locations, prepared tritium spiked samples and metals spiked samples were split with LBNL. All AIP samples were analyzed by SRLB; the laboratory was not provided with any information about the specific sample locations, specific times of collection, spiked samples, or duplication of samples.

Spiked tritium samples with known tritium activity and/or duplicate environmental samples were submitted along with routine samples on each sampling event to provide a means of validating the results in addition to the routine internal laboratory quality assurance / quality control program. The analytic results of these samples are well within limits of expected precision and accuracy, indicating that the sampling procedures, sample handling procedures, and analysis are appropriate and valid. The AIP Program has not had the opportunity to compare results with LBNL Environmental Monitoring Program.

Tables LBNL-7a, LBNL-7b and LBNL-7c summarize the result of tritium analysis from those sampling events. Table LBNL-7d contains the results of analysis of tritium spiked samples submitted from the field.

Tables LBNL-8a and LBNL-8b present the gross alpha, gross beta, and gamma spectroscopy results from samples collected December 15, 1994 and February 23, 1995; Table LBNL-8c presents the gross alpha and gross beta results from samples collected June 15, 1995 respectively.

Results of metals analysis for samples collected on February 23, 1995 are presented in table LBNL-9. One additional sample for metals analysis was collected from the surface water drainage system behind Building 75. This appears to be an inflow location, and is designated STW3 in the storm water monitoring plan.

Results in all tables reported with a less than symbol (<) indicate analysis results that were less than the minimum detectable activity (MDA).

Discussion of Surface Water Sampling Results

As reported in the AIP Program Annual Report for 1994, results of samples collected on December 15, 1994 and analyzed by SRLB for the AIP Program agree very well with the results of samples collected and analyzed by LBNL. The AIP program has been unable to obtain results

of LBNL's analysis for comparison of analytical results of samples collected on the two surface water sampling events in 1995 (February 23, 1995, & June 15, 1995).

Tritium analysis of surface water samples collected from Claremont Creek, near, but not associated with LBNL have not contained detectable levels of tritium. Samples collected from Wildcat Creek, on June 15, 1995, contained approximately 1000 picocuries per liter (pCi/l). This Stream is not directly associated with LBNL and there does not appear to be any clear explanation for the appearance of tritium in this stream. Samples collected from streams that flow through LBNL have reported relatively low, but detectable, levels of tritium activity (Tables LBNL-7a. LBNL-7b, & LBNL-7c). The level of this activity is not constant; it seems to vary with time of year and with sampling location. The highest tritium activity reported in samples collected by the AIP Program is less than 8% of the level that the US Environmental Protection Agency considers to be a safe level (protective of public health) in drinking water.

Results of gamma spectroscopy analysis, gross alpha and gross beta scans of surface water samples collected February 23, 1995 and June 15, 1995 are consistent with the range seen in natural background samples. Gamma spectroscopy results for samples collected February 23, 1995 are all below level of detection. Samples were not collected for gamma spectroscopy on June 15, 1995. Gross alpha analysis results of samples collected on both sampling events are essentially at or below minimum detectable activity, except for one. Reanalysis of this sample returned a result that was consistent with background.

Because some storm water samples collected by LBNL during 1992 contained elevated levels of some metals, the AIP Program collected samples on June 15, 1995 to be analyzed for arsenic, cadmium, chromium, mercury, lead, and selenium to evaluate baseline levels of these metals in streams. Analytical results for mercury and lead do not meet validation and quality assurance criterion, this has not been resolved and new samples should be collected for analysis. Arsenic, cadmium, chromium, and selenium were reported as less than detection limits. These samples should be repeated and samples from these locations should be analyzed for these metals periodically.

Suggested Areas for Further Investigation

- LBNL has a Storm Water Monitoring Program as one component of the NPDES General Permit for Storm Water Discharges Associated With Industrial Activities. The Annual Site Environmental Report for 1992 reported a significant increase in concentration of some metals between in-flow points and out-flow sampling locations. Most of the storm water sampling locations do not correspond to weekly surface water sampling locations, and weekly surface water samples are not routinely analyzed for metals, so it is difficult to evaluate the significance of these results. Does this condition exist in all streams at all times of the year or only during storms?

- Why is the level of tritium activity higher in Blackberry Creek than it is in Upper Strawberry Creek when a direct transport mechanism does not appear to exist. Blackberry Creek drains a different watershed than the presumed source of tritium at LBNL -- National Tritium Labeling Facility (NTLF)? The stable isotope result for the sample collected from Blackberry Creek on June 15, 1995 is consistent with water that been subject to evaporation, as would likely be found in a cooling tower.

- Is weekly sampling adequate to appropriately characterize the tritium activity, given the amount of variability that is apparent in the tritium activity in samples collected from surface water? A coordinated comprehensive sampling plan for surface water, storm water, and rain water analyzed for tritium and stable isotopes would provide for better comparability between the analytic results and possibly provide some explanation for the variability as well as some insight into possible transport mechanisms and sources of contamination.

- LBNL surface water sampling practice is to label the samples with a identifier that also indicates the sampling location. LBNL does not routinely submit duplicate samples, but the laboratory does apparently create duplicate aliquats as part of their internal QA/QC procedures. It is also important to validate the entire sampling procedure from the field, through analysis; duplicate samples and spiked samples, submitted without indication of their origin, would serve this purpose.

- The two samples with detectable tritium activity collected from Wildcat Creek on June 15, 1995, should not be dismissed as a sampling artifact or anomaly without further investigation.

Groundwater Monitoring

The geology of LBNL is a complex assortment of faulting, folding, and interbedding. The hydrogeology reflects that complexity with variable water levels, discontinuous and localized aquifers with contrasting permiabilities. Detectable levels of tritium have been seen in monitoring wells and slope-stability wells in areas 3, 4, and 5, as well as from hydraugers down slope from the National Tritium Labeling Facility. Plumes of groundwater contaminated with volatile organic compounds (VOCs), fuels, and chlorinated hydrocarbons have been discovered in several areas; LBNL has an active program to characterize and monitor the plumes, identify the sources, and evaluate remediation measures.

AIP Program groundwater monitoring activities at LBNL have been designed to provide an additional level of quality assurance, not to replace or supplement the activities of the Environmental Restoration Group's ongoing groundwater monitoring program. In 1995, AIP

Program personnel from DHS and SWRCB accompanied the LBNL groundwater sampling team to split samples on two occasions.

Samples collected on May 11, 1995 were analyzed for organic compounds by the Regional Water Quality Control Board Central Valley Region Laboratory, and for general minerals by Department of Health Services Sanitation Radiation Laboratory in Berkeley (SRLB). Samples collected on June 6, 1995 were analyzed for general minerals and organic compounds by SRLB. These results are reported in Table LBNL-9; VOC constituents not listed were not detected by either laboratory.

Discussion of Groundwater Sampling Results

The analytic results reported by LBNL agree very well with results reported by the AIP Program. It is not appropriate (given this relatively small data set and limited period of time that it covers) to comment further on the LBNL groundwater monitoring program or hydrogeology models of this complex site. It is anticipated that SWRCB will be continuing this program and will possibly have further comments in their annual report.

Stable Isotope Study

Natural variations in the abundance of stable, or non-radiogenic, isotopes of hydrogen and oxygen can be used to provide some clue to the sources of bodies of water and assist with hydrogeologic assessment of a site. Groundwater samples have been analyzed for stable isotopes previously, but there has been no comprehensive systematic collection; the AIP Program initiated such a study, with the understanding that stable isotope data might possibly provide some information that would provide a more comprehensive characterization of the hydrogeology at LBNL.

In cooperation with LBNL the AIP Program began collecting samples of surface water and ground water for stable isotope analysis. Surface water samples were collected by AIP Program staff as they accompanied LBNL Environmental Monitoring staff on their weekly surface water sampling trips-- December 15, 1994, February 23, 1995, and June 15, 1995; groundwater samples were collected either by AIP personnel when they accompanied LBNL groundwater sampling crew, or the groundwater sampling crew, by agreement with LBNL Environmental Restoration Group, routinely collected samples that were subsequently retrieved by AIP Personnel. All samples were submitted to the laboratory without indication of their origin; upon receipt of the analytic results, the AIP Program associated the sample identifiers with the sampling location and released that information to both the Environmental Monitoring Group and the Environmental Restoration Group (See Maps: "Monitoring Well Locations", and two maps "Oxygen Stable Isotope Ratios". It should be noted that approximately 20 percent of the samples submitted were duplicates; about

half submitted with the same batch and the remainder with a different batch of samples. The sults of these duplicate samples provide assurance that the laboratories internal quality assurance/ quality control program is appropriate and effective; they also validate the entire sampling procedure.

Discussion of Stable Isotope Sampling Results

Oxygen and Hydrogen isotopes are differentially fractionated during evaporation and condensation; as a result $\delta^{18}O$ value of rain that falls in the Berkeley area average about -7‰ and rain that falls in the Sierra averages about -13‰. It can be expected that the groundwater in an area will be equivalent to the rain that supplies the water to recharge the aquifer. Since LBNL receives municipal water from East Bay Municipal Utility District (EBMUD) which has its origin in the Sierra, leakage from this system into the local groundwater will be apparent in more negative $\delta^{18}O$ values in the local water.

The analytic results of the AIP Program stable isotope sampling program ($\delta^{18}O$ & δD--May & June 1995) are presented in Table AIP95 along with oxygen stable isotope ratios from previous studies at LBNL. It is apparent that there has been no gross change in the stable isotope ratios for individual wells between July 1992 and May/June 1995.

The map "Areas of Low Oxygen Stable Isotope Ratios" indicate areas it must be suspected that the local groundwater is being infiltrated from leaks in the municipal water lines or sewer lines. Note also that there are several such areas that are not indicated on the map "Spacial variability of Oxygen Isotope Ratios" from 1992-3, as well as areas where the area of infiltration appears to have increased. Groundwater monitoring wells in many of these areas have reported detectable levels of various contaminants; while this is not direct evidence of a correlation between the groundwater contamination and tap water infiltration, the circumstantial evidence appears sufficient to warrant an investigation. The infiltrating tap water could be providing a vehicle to transport the contaminants.

The stable isotope ratio of the surface water samples collected from Upper Strawberry Creek, Lower Strawberry Creek, and Blackberry Creek on June 15, 1995 are interesting; The sample from Blackberry Creek is considerably less negative than would be expected, in fact, it is consistent with water that been subject to evaporation, as would likely be found in a cooling tower. The stable isotope ratio of the sample from Upper Strawberry is consistent with expectations and the sample results from Lower Strawberry are consistent with mixing of the two streams. This should be investigated to ensure that the source of water that is responsible for the shift in stable isotope ratios in Blackberry Creek is not also an unexpected source of contamination.

Suggested Areas for Further Investigation

- Samples of groundwater and surface water should be collected for analysis of stable isotope ratios for, at least, several more quarters. Ideally samples should be collected during both wet and dry seasons. This would possibly provide information on the sources and movement of plumes of groundwater contaminants, as well as insight into the source of surface water.

- Analysis of groundwater and surface water stable isotope results should be coordinated with investigation of tritium in transpired vapor from plants on LBNL. This may provide information on the sources of tritium in some streams that can not easily be explained as surface run-off.

- Persistent low $\delta^{18}O$ anomalies discovered on LBNL indicate areas of significant breaches in the site's facility (municipal) water, sanitary sewer water, and possibly low conductivity water systems. It is important to repair these breaches and continue to monitor these anomalies. Because LBNL is prone to slope stability problems, it may be anticipated that new water leaks will occur in the future. Since thes leaks may contribute to slope stability problems, waste water, and aggravate groundwater contamination problems, analysis of stable isotope ratios should be added to the routine groundwater monitoring program.

Recommendations

1. Evaluate the effects of shielding, by the metal of the environmental monitoring buildings on the direct radiation monitoring dosimeters.

2. Restructure the calculations to convert TLD light outputs to radiation measurements to yield actual exposure.

3. Automated surface water VOC sampling equipment could be used to collect storm water samples to be analyzed for stable isotope ratios and tritium concentration. This could provide for a better understanding of the sources of tritium in surface water.

4. A research program, within the LBNL Environmental Monitoring Group, analyzing tritium and stable isotope ratios in transpired water vapor of plants on LBNL should be coordinated with all the other environmental tritium monitoring programs.

5. LBNL should send split environmental samples and split spiked samples for comparative analysis between contract and in-house laboratories as part of an on-going QA/QC program.

6. LBNL Environmental Monitoring Group should revise sampling procedures to facilitate

submitting sample to the laboratory without indication of sample origin; this would allow duplicate and spiked samples to be submitted from the field as part of a comprehensive quality assurance program.

7. The LBNL tritium in air sampling program should be evaluated. Several (two or three) higher volume air samplers using indicator silica gel, similar to those used by Sandia National Laboratory CA (SNLCA) or Lawrence Livermore National Laboratory (LLNL) should be placed near the current LBNL. Silica gel sampling medium should be split with either SNLCA or LLNL for comparative analysis and QA/QC.

8. Water for analysis of tritium activity should be extracted from the silica gel collection medium of the tritium in air sampling equipment with a freeze drying process.

9. LBNL should set up air particulate sampling equipment to collect samples for isotopic analysis for curium-244 (^{244}Cm) near Building 71.

Other Areas Suggested for Future Oversight Investigations.

- Tritium in the form of HTO released from the National Tritium Labeling Facility Stack is the primary radionuclide released from the Lawrence Berkeley National Laboratory. The AIP Program has questioned the efficiency and validity of the tritium in air measurement equipment. The quantity of silica gel appears to be too small to collect an appropriately sized sample without the danger of "breakthrough", the low air flow volume through the silica gel appears to draw questions as to the validity of the samples on the basis of their small sample size, and the method of analysis -- eluting the tritium from the silica gel with a small quantity of water -- may be appropriate with high concentrations but appears questionable for determination of environmental levels. The AIP Program has constructed tritium in air sampling equipment that should provide for a relatively large volume of air flowing through what is probably a sufficiently large quantity of silica gel. These, or similar, air samplers should be placed near the LBNL tritium in air monitors. The silica gel should be an indicator type to evaluate breakthrough, and the collected moisture should be extracted from the silica gel sampling medium by freeze drying prior to liquid scintillation counting.

- During the July 26, 1995 Quarterly Environmental Restoration Program, Quarterly Meeting with Regulatory Agencies, a solution was proposed to an issue identified during a DOE audit. The issue was that LBNLs recorded number of Solid Waste Management Units (SWMUs), Areas of Concern (AOCs), and designation of lead regulatory agency was not consistent with a July 29, 1993 Department of Toxic Substance Control (DTSC) letter. The proposed solution is a revised list; this revision, in addition to giving AOC designation to areas that were previously identified as Other Investigation Areas (OIAs),

identifies DHS as the lead regulatory agency for six areas that were previously identified as the responsibility of DTSC, one has been approved for "No Further Investigation Status" by DTSC. There are several reasons why "providing this updated list to the regulators" may <u>not</u> be sufficient to gain closure of this issue.

1. This revision was made without consulting DHS AIP Program.

2. This revision presumes regulatory authority not vested in the California AIP Program by the Agreement in Principle between the Department of Energy and the State of California. The AIP Program's mandate is to "assure the citizens of the State of California that health, safety, and the environment are being protected through existing programs and new commitments by DOE, through a vigorous program of independent monitoring and oversight by the State of California".

3. The revised list and the text of the meeting summary seem to infer that the AIP Program's field of interest is limited to radiologic concerns - there are no limitations on the scope of inquiry for the AIP Program, either explicit or implicit, in the Agreement in Principle.

The AIP Program has been reviewing documents and programs, providing comments and consultation, and participating with LBNL Environmental Monitoring and Environmental Restoration Programs by splitting surface water and groundwater samples for independent analysis (see above). The AIP Program has not had the opportunity to participate in any investigations of specific AOCs or SWMUs, nor has it had regulatory authority to require specific investigations in specific areas. The AIP Program has identified some concerns with respect to the areas identified in the revised list as being the responsibility of the AIP Program, and it is appropriate, with the imminent termination of the program, to summarize the status of those specific areas as suggestions for further investigation and/or oversight. The following summaries identified by the AOC or SWMU identifiers, building numbers, and descriptions used in the "revised list".

SWMU 3-7 **B-75** **National Tritium Labeling Facility**

This area is listed in the 1992 *RCRA Facility Investigation Work Plan LBL*. This facility handles kilocurie quantities of tritium (^3H) to label a variety of molecules that are subsequently employed in chemical, pharmaceutical, and biomedical research. It is conceded that releases from the tritium-stack as well as fugitive releases from Building-75 are the primary source of tritium at LBNL. Air-fall, rainout, and possibly transport in fog impacts soil, groundwater, and surface water There is an area of tritium contaminated groundwater in the vicinity of Building 75. The *Quarterly Progress Report, First Quarter FY 1992*, (May 1993) reports sampling ten hydraugers, one, immediately down-slope from NTLF, reportedly contained 32,000 pCi/L of tritium. Apparently releases have been reduced from years past, but cannot be completely curtailed. During 1993, there was one unplanned tritium release from Building 75. The 1993 Site Environmental Report

indicates that this was 44 Ci of tritium as HTO, but the occurrence report filed with DOE lists three other estimates of amount released ranging from 24 to 68 Ci. The AIP Program has proposed that DOE audit the tritium inventory, use, and recovery to ensure proper quality control and validity of results. LBNL has recently installed new monitoring equipment in the NTLF tritium stack, but the AIP Program has not had the opportunity to review either the installation or any data derived from it.

The AIP Program has, several times, questioned and expressed concern over the efficiency and validity of the methods employed at LBNL to measure and monitor airborne tritium -- the quantity of silica gel appears to be rather small, the air volume (sample size) is relatively low, and there are questions as to the efficiency of the method employed to extract the tritium from the silica gel. The AIP Program also would question the representativeness of the measurements since the air intakes for the monitoring equipment are inside environmental monitoring buildings, rather than in the environment. LBNL announced at the Quarterly Review Meeting April 27, 1994 that the task of compiling a tritium risk assessment has been given to an outside contractor. Any risk assessment is inherently dependant on the validity of the monitoring results, as it currently stands, the validity of the tritium in air monitoring results may be questionable. The concern is that the collection and analytical methods have an inherent bias, understating the quantity of tritium in the air. Any risk assessment would, of necessity, reflect the uncertainties and biases of the original data.

Sandia National Laboratory CA (SNLCA) and Lawrence Livermore National Laboratory (LLNL use tritium in air monitoring systems that are designed for higher flow rates and larger volumes of silica gel; the AIP Program has assembled several similar systems. At least two systems similar to these could be installed near LBNL's tritium in air samplers for comparison sampling. The inlet tubes for these air samplers should be in the outside air, not inside the environmental monitoring buildings. The silica gel samples should be analyzed using freeze drying to extract the water and a low background liquid scintillation counter to evaluate the tritium activity.

Analysis of surface water samples collected by the AIP Program demonstrate that tritium is detectable in surface water around LBL. While tritium activity in the samples collected by the program were low enough that they would not pose a threat to public health, its appearance in some streams can not easily be explained as surface run-off. One recent investigation, by Leticia Menchaca (LBNL), analyzing for tritium in transpired vapor from plants on LBNL suggest that there may be significant amounts of tritium in the upper, non-saturated, soil strata. It appears that there may be sufficient evidence to suggest that there may be more tritium in the environment than previously suspected. There are apparently no validated explanations for the appearance of tritium in streams not obviously associated with NTLF.

AOC 1-7 B-71 Radiation Release

An area of soil near Building 71 is historically (circa 1959) reported to have been

contaminated with Curium-244 when a Curium target being used in an experiment was vaporized. Some of this contamination, reportedly, was transported by the buildings ventilation system and deposited outside. This is documented in two interviews in the *RCRA Facility Assessment at LBL Sep. 30, 1992*; this document reports that "Cleanup of curium contaminated concrete inside the building is documented but there is no record of sampling outside Bld 71," and suggests that if no documentation of outdoor sampling can be found, first phase RFI work will include collection of shallow soil samples from areas not covered by concrete or asphalt."

The *RCRA Facility Investigation Vol: 1 1992*, proposes that "Samples of soil downwind of the building [B-71] need to be screened for radioactivity." The *RCRA Facility Investigation Phase I Progress Report 1994* reports the results of nine soil samples. Curium-244 was detected in six, the highest concentration reported was 0.38 pCi/g. The *Quarterly Progress Report First Quarter FY1994 (May 1995)*, reports that six soil samples were collected, during second quarter FY93, from an area northeast of Building 71, and ^{244}Cm was detected at concentration up to 0.38 pCi/g. No ^{244}Cm has been detected in groundwater samples from wells in the area.

In conversations with LBNL staff it has been indicated that the potentially curium contaminated hillside has been modified, and there is probably no evidence of the spill there. The AIP Program has not had an opportunity to review sampling plans, sample location selection rational, sampling procedures or final report. Because wind direction and velocity are not constant, and especially since local wind direction and velocity are a function of the complex topography of the LBL site, "downwind" should perhaps be interpreted rather broadly. ^{244}Cm was detected in soil samples collected in 1993; this should be examined, and the area resampled to evaluate the extent, amount and potential for run-off. Storm water from this area should possibly also be analyzed for ^{244}Cm.

SMU 3-9 (DTSC unit # SWMU-27) B75A Radioactive Waste Storage Area

This area is listed as approved for no further investigation, 9/14/93, with no comment by DTSC.

The *1993 Site Environmental Report for Lawrence Berkeley Laboratory*, reports "storing two shielded gamma irradiators in the building 75 waste yard behind a large earth berm to minimize worker exposure. One unit contains 543 Curies (Ci) of ^{137}CS and the other unit contains 270 Ci of ^{60}Co. The gamma radiation field attributable to these irradiators measured at the perimeter fence nearest to the devices was less than 2 μrem/hr, which results in an annual fence-post dose of less than 18 mrem/year. However, the perimeter fence at this location is on UCB land, and there are no residences or off-site workplaces in the immediate vicinity. The nearest off-site workplace (40 Hour/week occupancy) is the Lawrence Hall of Science, which is approximately 270 meters from the fence. The nearest residence is approximately 500 meters away. Both of these off-site locations are

shielded by a hillside. The claim is made that even if the hillside shielding is ignored, the predicted dose from these irradiators would be about 0.005 mrem/yr and 0.007 mrem/yr at the Lawrence Hall of Science and at the nearest residence respectively. The retired irradiators are reportedly clearly marked, barricaded, and cordoned off. The dose rate at the nearest accessible distance to these units is predicted to be approximately 0.2 mrem/hr".

The AIP Program has not had an opportunity to review or comment on any report or study of this area. It is uncertain whether the predicted dose at the LBL boundary, or at either off-site location has been confirmed with long term environmental dosimetry. The Direct Radiation Monitoring at Lawrence Berkeley Laboratory should be reviewed to determine whether TLD placement should be reviewed.

SWMU 10-1 **B-4** **Former Radioactive Waste Storage and Staging Area**

This area does not appear to be mentioned in RCRA Facility Investigation Work Plan LBL, 1992. The *Quarterly Progress Report First Quarter FY 1995* lists it as being the responsibility of DTSC.

No Further Investigation status was requested by LBL in the *RCRA Facility Investigation Phase I Progress Report, November 1994.*

The AIP Program has not had an opportunity to review or comment on any report or study of this area. If this area has not been surveyed and found to be free of significant radiologic contamination, it should not be released for unrestricted access.

SWMU 10-2 **B-5** **Former Radioactive Decontamination Area**

The *Quarterly Progress Report First Quarter FY 1993* lists this as a former decontamination area. The *Quarterly Progress Report First Quarter FY 1995* lists this as being an active RFI investigation site, calling it a former outdoor radioactive waste storage area, and reports detectable levels of strontium-90 beneath the concrete slab. The *Quarterly Progress Report Third Quarter FY 1995* July 26, 1995, reports two soil borings reported as "Within Background" for alpha, beta, and gamma.

The AIP Program has not had an opportunity to review or comment on any report or study of this area. Without further explanation the report of "no gamma radiation detected with a detection limit of 200 pCi/l" and two soil borings reported as "within background" are rather ambiguous. Consideration should also be given to the number of samples necessary to characterize this site, as well as the possibility that contamination may have been transported away from this area in

water; soil from areas where run off water could collect as well as sediment in storm drains, sewer drains, and traps should also be evaluated.

SWMU 10-3 **B-5** **Former Outdoor Radioactive Waste Storage Area**

This unit appears in the *RCRA Facility Investigation Work Plan LBL*, 1992, and The *Quarterly Progress Report First Quarter FY 1995* lists this as being an active RFI investigation site with DTSC as the lead agency.

The AIP Program has not had an opportunity to review or comment on any report or study of this area.

SWMU 11-2 **B-74** **Abandoned Above-ground Rad Waste Holding Tanks**

This unit is listed in the *RCRA Facility Investigation Work Plan LBL*, 1992 as formerly above-ground, and now buried under an addition to building 74. The *Quarterly Progress Report First Quarter FY 1995* lists this as being an active RFI investigation site with DTSC as the lead agency.

The AIP Program has not had an opportunity to review or comment on any report or study of this area. If these tanks were used for radioactive waste, the interiors should have been surveyed, and any residues sampled and analyzed for radioactive contamination. If they were not surveyed and found to be free of radiologic contamination before they were buried under an addition to building 74, this could pose a significant hurdle to be crossed if the site is ever to be released for unrestricted use.

SWMU 11-3 **B-74** **Six Inactive Aboveground Rad Waste Holding Tanks**

This does not appear to be listed in the *RCRA Facility Investigation Work Plan LBL, 1992*, but the *Quarterly Progress Report first quarter FY 1995* lists it as an active RFI investigation site with DTSC as the lead agency.

The AIP Program has not had an opportunity to review or comment on any report or study of this area.